

THE INVENTION CLAIMED IS

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1. In a wavelength router for fiber optical networking and computer interconnects, the improvement comprising:

at least one diffraction grating which utilizes only N wavelengths to interconnect N inputs to N outputs in a fully non-blocking manner, *wherein N is any number*

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2. The improvement of Claim 1, wherein said diffraction grating is augmented by elements selected from the group ^{*first mentioned*} of coupler and wavelength selective elements to provide fully non-blocking interconnection. *consisting*

3. The improvement of Claim ^{*2*}1, wherein said coupler is selected from the group consisting of directional couplers and wavelength-selective couplers.

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4. The improvement of Claim 3, wherein said ^{*coupler comprises a*} wavelength-selective coupler ^{*which*} comprises an optical wavelength add-drop multiplexer.

5. The improvement of Claim 1, additionally including ^{*a second*} another diffraction grating position to receive outputs from said first mentioned diffraction grating.

6. The improvement of Claim ^{*1*}5, wherein said diffraction gratings are identical.

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7. The improvement of 6, additionally including a collection optic assembly positioned to receive outputs from said ^{*second*} another diffraction grating, and

a plurality of filter modules positioned to receive outputs from said collection optic assembly.

8. The improvement of Claim 7, wherein said filter modules each comprise wavelength selective add/drop filter modules.

5 9. The improvement of Claim 7, wherein each of said filter modules include different filters.

10 10. The improvement of Claim 7, wherein said plurality of filter modules comprises N-1 different filters for ^{said} N inputs and ^{said} N wavelengths, ^{wherein N is any number}

10 11. The improvement of Claim 5, additionally including at least one collection and re-direction optic assembly position to direct inputs to said first-mentioned diffraction grating, and a retro-reflector assembly position to receive outputs from said ^{second} ~~another~~ diffraction grating and reflect certain of said outputs back through said diffraction grating.

15 12. The improvement of Claim 11, wherein said collection and re-direction optic assembly additionally redirects the reflected outputs back through the diffraction grating.

13. The improvement of Claim 11, wherein said retro-reflector assembly is constructed to vertically displace and retro-reflect ^N ~~[n]~~ 1 beams, ^{wherein N is any number}

20 14. The improvement of Claim 8, wherein said filter modules are of a 3-port type.

15 15. The improvement of Claim ⁴ ~~1~~, additionally including at least one coupler for combining outputs from said at least one diffraction grating.

16. A wavelength-conserving grating router for intermediate wavelength density, including:

at least one diffraction grating for receiving a number of inputs and for discharging a greater number of outputs, and

including a second diffraction grating
means for combining at least a portion of said outputs.

17. The grating router of Claim 16, wherein said means for combining at least a portion of said outputs is selected from directional couplers and wavelength-selective couplers.

18. The grating router of Claim 17, wherein said wavelength selective couplers includes optical wavelength add-drop multiplexers.

19. The grating router of Claim 16, wherein said means includes a second diffraction grating.

20. The grating router of Claim ¹⁶~~19~~ additionally including assemblies operatively connected to said diffraction gratings selected from the group consisting of collection and re-direction optic and retro-reflector assemblies, and collection optics and filter module assemblies.

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